(4) Where properly measured DRE is used to report emissions, dated certification by the technician who made the measurement that the destruction or removal efficiency is calculated in accordance with methods in EPA 430–R–10–003 (incorporated by reference, see § 98.7), complete documentation of the results of any initial and subsequent tests, and the final report as specified in EPA 430–R–10–003 (incorporated by reference, see § 98.7).

(e) Purchase records for gas purchased.

(f) Invoices for gas purchases and sales.

(g) Documents and records used to monitor and calculate abatement system uptime.

(h) GHG Monitoring Plans, as described in § 98.3(g)(5), must be completed by April 1, 2011. You must update your GHG Monitoring Plan to comply with § 98.94(c) consistent with the requirements in § 98.3(g)(5)(iii).

§ 98.98 Definitions.

Except as provided in this section, all of the terms used in this subpart have the same meaning given in the Clean Air Act and subpart A of this part. If a conflict exists between a definition provided in this subpart and a definition provided in subpart A, the definition in this subpart takes precedence for the reporting requirements in this subpart.

Abatement system means a device or equipment that destroys or removes fluorinated GHGs and N_2O in waste streams from one or more electronics manufacturing production processes.

Actual gas consumption means the quantity of gas used during wafer/substrate processing over some period based on a measured change in gas container weight or gas container pressure or on a measured volume of gas.

By-product formation means the creation of fluorinated GHGs during electronics manufacturing production processes or the creation of fluorinated GHGs by an abatement system. By-product formation is the ratio of the mass of the by-product formed to the mass flow of the input gas, where, for multi-fluorinated-GHG recipes, the denominator corresponds to the fluorinated GHG with the largest mass flow.

Chamber cleaning is a process type that consists of the process sub-types defined in paragraphs (1) through (3) of this definition.

(1) In situ plasma process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent that is dissociated into its cleaning constituents by a plasma generated inside the chamber where the film is produced.

(2) Remote plasma process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent dissociated by a remotely located plasma source.

(3) In situ thermal process sub-type consists of the cleaning of thin-film production chambers, after processing substrates, with a fluorinated GHG cleaning reagent that is thermally dissociated into its cleaning constituents inside the chamber where thin films are produced.

Class means a category of abatement systems grouped by manufacturer model number(s) and by the gas that the system abates, including N_2O and carbon tetrafluoride (CF_4) direct emissions and by-product formation, and all other fluorinated GHG direct emissions and by-product formation. Classes may also include any other abatement systems for which the reporting facility wishes to report controlled emissions provided that class is identified.

Controlled emissions means the quantity of emissions that are released to the atmosphere after application of an emission control device (*e.g.*, abatement system).

Destruction or removal efficiency (DRE) means the efficiency of an abatement system to destroy or remove fluorinated GHGs, N_2O, or both. The destruction or removal efficiency is equal to one minus the ratio of the mass of all relevant GHGs exiting the abatement system to the mass of GHG entering the abatement system. When GHGs are formed in an abatement system, destruction or removal efficiency is expressed as one minus the ratio of amounts of exiting GHGs to the

amounts entering the system in units of CO_2-equivalents (CO_2e).

Gas utilization means the fraction of input N_2O or fluorinated GHG converted to other substances during the etching, deposition, and/or wafer and chamber cleaning processes. Gas utilization is expressed as a rate or factor for specific electronics manufacturing recipes, process sub-types, or process types.

Heat transfer fluids are fluorinated GHGs used for temperature control, device testing, and soldering in certain types of electronic manufacturing production processes. Heat transfer fluids used in the electronics sector include perfluoropolyethers, perfluoroalkanes, perfluoroethers, tertiary perfluoroamines, and perfluorocyclic ethers. Electronics manufacturers may also use these same fluorinated chemicals to clean substrate surfaces and other parts.

Heel means the amount of gas that remains in a gas container after it is discharged or off-loaded; heel may vary by container type.

Individual recipe means a specific combination of gases, under specific conditions of reactor temperature, pressure, flow, radio frequency (RF) power and duration, used repeatedly to fabricate a specific feature on a specific film or substrate.

Maximum designed substrate starts means the maximum quantity of substrates, expressed as surface area, that could be started each month during a reporting year if the facility were fully equipped as defined in the facility design specifications and if the equipment were fully utilized. It denotes 100 percent of annual manufacturing capacity of a facility.

Modeled gas consumed means the quantity of gas used during wafer/substrate processing over some period based on a verified facility-specific engineering model used to apportion gas consumption.

Nameplate capacity means the full and proper charge of chemical specified by the equipment manufacturer to achieve the equipment's specified performance. The nameplate capacity is typically indicated on the equipment's nameplate; it is not necessarily the actual charge, which may be influenced by leakage and other emissions.

Operational mode means the time in which an abatement system is being operated within the range of parameters as specified in the operations manual provided by the system manufacturer.

Plasma etching is a process type that consists of any production process using fluorinated GHG reagents to selectively remove materials from a substrate during electronics manufacturing. The materials removed may include SiO_2, SiO_X-based or fully organic-based thin-film material, SiN, SiON, Si_3N_4, SiC, SiCO, SiCN, etc. (represented by the general chemical formula, $Si_wO_XN_yX_z$ where w, x, y and z are zero or integers and X may be some other element such as carbon), substrate, or metal films (such as aluminum or tungsten).

Process sub-type is a set of similar manufacturing steps, more closely related within a broad process type. For example, the chamber cleaning process type includes in-situ plasma chamber cleaning, remote plasma chamber cleaning, and in-situ thermal chamber cleaning sub-types.

Process types are broad groups of manufacturing steps used at a facility associated with substrate (*e.g.*, wafer) processing during device manufacture for which fluorinated GHG emissions and fluorinated GHG usages are calculated and reported. The process types are Plasma etching, Chamber cleaning, and Wafer cleaning.

Properly measured destruction or removal efficiency means destruction or removal efficiencies measured in accordance with EPA 430–R–10–003 (incorporated by reference, see § 98.7).

The Random Sampling Abatement System Testing Program (RSASTP) means the required frequency for measuring the destruction or removal efficiencies of abatement systems in order to apply properly measured destruction or removal efficiencies to report controlled emissions.

Redundant abatement systems means a system that is specifically designed, installed and operated for the purpose of destroying fluorinated GHGs and N_2O gases. A redundant abatement system is used as a backup to the main

fluorinated GHGs and N_2O abatement system during those times when the main system is not functioning or operating in accordance with design and operating specifications.

Repeatable means that the variables used in the formulas for the facility's engineering model for gas apportioning factors are based on observable and measurable quantities that govern gas consumption rather than engineering judgment about those quantities or gas consumption.

Similar, with respect to recipes, means those recipes that are composed of the same set of chemicals and have the same flow stabilization times and where the documented differences, considered separately, in reactor pressure, individual gas flow rates, and applied radio frequency (RF) power are less than or equal to plus or minus 10 percent. For purposes of comparing and documenting recipes that are similar, facilities may use either the best known method provided by an equipment manufacturer or the process of record, for which emission factors for either have been measured.

Trigger point for change out means the residual weight or pressure of a gas container type that a facility uses to change out that gas container.

Uptime means the ratio of the total time during which the abatement system is in an operational mode with fluorinated GHGs or N_2O flowing through production process tool(s) connected to that abatement system, to the total time during which fluorinated GHGs or N_2O are flowing through production process tool(s) connected to that abatement system.

Wafer cleaning is a process type that consists of any production process using fluorinated GHG reagents to clean wafers at any step during production.

Wafer passes is a count of the number of times a wafer substrate is processed in a specific process recipe, sub-type, or type. The total number of wafer passes over a reporting year is the number of wafer passes per tool multiplied by the number of operational process tools in use during the reporting year.

Wafer starts means the number of fresh wafers that are introduced into the fabrication sequence each month. It includes test wafers, which means wafers that are exposed to all of the conditions of process characterization, including but not limited to actual etch conditions or actual film deposition conditions.

TABLE I–1 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS FOR THRESHOLD APPLICABILITY DETERMINATION

Product type	Emission factors EF_i					
	CF_4	C_2F_6	CHF_3	C_3F_8	NF_3	SF_6
Semiconductors (kg/m^2)	0.90	1.00	0.04	0.05	0.04	0.20
LCD (g/m^2)	0.50	NA	NA	NA	0.90	4.00
MEMS (kg/m^2)	NA	NA	NA	NA	NA	1.02

Notes: NA denotes not applicable based on currently available information.

TABLE I–2 TO SUBPART I OF PART 98—EXAMPLES OF FLUORINATED GHGS USED BY THE ELECTRONICS INDUSTRY

Product type	Fluorinated GHGs used during manufacture
Electronics	CF_4, C_2F_6, C_3F_8, c-C_4F_8, c-C_4F_8O, C_4F_6, C_5F_8, CHF_3, CH_2F_2, NF_3, SF_6, and HTFs (CF_3-(O–$CF(CF_3)$-$CF_2)_n$-(O–$CF_2)_m$-O–CF_3, C_nF_{2n+2}, $C_nF_{2n+1}(O)C_mF_{2m+1}$, $C_nF_{2n}O$, $(C_nF_{2n+1})_{3N}$).

TABLE I–3 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR SEMICONDUCTOR MANUFACTURING FOR 150MM AND 200 MM WAFER SIZES

Process type/Sub-type	Process gas i										
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3	SF_6	C_4F_6	C_5F_8	C_4F_8O
Plasma Etching											
$1–U_i$	0.69	0.56	0.38	0.093	NA	0.25	0.038	0.20	0.14	NA	NA
BCF_4	NA	0.23	0.026	0.021	NA	0.19	0.0040	NA	0.13	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	0.084	NA	NA	0.12	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chamber Cleaning											
In situ plasma cleaning:											
$1–U_i$	0.92	0.55	NA	NA	0.40	0.10	0.18	NA	NA	NA	0.14
BCF_4	NA	0.19	NA	NA	0.20	0.11	0.011	NA	NA	NA	0.13
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.030
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remote plasma cleaning:											
$1–U_i$	NA	NA	NA	NA	NA	NA	0.018	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.0047	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
In situ thermal cleaning:											
$1–U_i$	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wafer Cleaning											
$1–U_i$	0.77	NA	NA	0.24	NA	NA	0.23	0.20	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: NA denotes not applicable based on currently available information.

TABLE I–4 TO SUBPART I OF PART 98–DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR SEMICONDUCTOR MANUFACTURING FOR 300 MM WAFER SIZE

Process type/sub-type	Process gas i										
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3	SF_6	C_4F_6	C_5F_8	C_4F_8O
Plasma Etching											
$1–U_i$	0.80	0.80	0.48	0.14	NA	0.29	0.32	0.37	0.09	NA	NA
BCF_4	NA	NA	0.0018	0.0011	NA	0.079	NA	NA	0.27	NA	NA
BC_2F_6	NA	NA	0.0011	NA	NA	0.12	NA	NA	0.29	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chamber Cleaning											
In situ plasma cleaning:											
$1–U_i$	NA	NA	NA	NA	NA	NA	0.23	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.0046	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Remote Plasma Cleaning:											
$1–U_i$	NA	NA	NA	NA	0.063	NA	0.018	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.040	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
In Situ Thermal Cleaning:											

TABLE I–4 TO SUBPART I OF PART 98–DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR SEMICONDUCTOR MANUFACTURING FOR 300 MM WAFER SIZE—Continued

Process type/sub-type	Process gas i										
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3	SF_6	C_4F_6	C_5F_8	C_4F_8O
$1–U_i$	NA	NA	NA	NA	NA	NA	0.28	NA	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	0.010	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wafer Cleaning											
$1–U_i$	0.77	NA	NA	0.24	NA	NA	0.23	0.20	NA	NA	NA
BCF_4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_2F_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes: NA denotes not applicable based on currently available information.

TABLE I–5 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS ($1–U_{ij}$) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR MEMS MANUFACTURING

Process type factors	Process gas i											
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3 Remote	NF_3	SF_6	C_4F_{6a}	C_5F_{8a}	$C_4F_8O_a$
Etch $1–U_i$	0.7	[1] 0.4	[1] 0.4	[1] 0.06	NA	[1] 0.2	NA	0.2	0.2	0.1	0.2	NA
Etch BCF_4	NA	[1] 0.4	[1] 0.07	[1] 0.08	NA	0.2	NA	NA	NA	[1] 0.3	0.2	NA
Etch BC_2F_6	NA	NA	NA	NA	NA	0.2	NA	NA	NA	[1] 0.2	0.2	NA
CVD $1–U_i$	0.9	0.6	NA	NA	0.4	0.1	0.02	0.2	NA	NA	0.1	0.1
CVD BCF_4	NA	0.1	NA	NA	0.1	0.1	[2] 0.02	[2] 0.1	NA	NA	0.1	0.1
CVD BC_3F_8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4

Notes: NA denotes not applicable based on currently available information.
[1] Estimate includes multi-gas etch processes.
[2] Estimate reflects presence of low-k, carbide and multi-gas etch processes that may contain a C-containing fluorinated GHG additive.

TABLE I–6 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS (1–U_{ij}) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR LCD MANUFACTURING

Process type factors	Process Gas i								
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3 Remote	NF_3	SF_6
Etch 1–U_i	0.6	NA	0.2	NA	NA	0.1	NA	NA	0.3
Etch BCF_4	NA	NA	0.07	NA	NA	0.009	NA	NA	NA
Etch $BCHF_3$	NA	NA	NA	NA	NA	0.02	NA	NA	NA
Etch BC_2F_6	NA	NA	0.05	NA	NA	NA	NA	NA	NA
CVD 1–U_i	NA	NA	NA	NA	NA	NA	0.03	0.3	0.9

Notes: NA denotes not applicable based on currently available information.

TABLE I–7 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS (1–U_{ij}) FOR GAS UTILIZATION RATES (U_{ij}) AND BY-PRODUCT FORMATION RATES (B_{ijk}) FOR PV MANUFACTURING

Process type factors	Process Gas i								
	CF_4	C_2F_6	CHF_3	CH_2F_2	C_3F_8	c-C_4F_8	NF_3 Remote	NF_3	SF_6
Etch 1–U_i	0.7	0.4	0.4	NA	NA	0.2	NA	NA	0.4
Etch BCF_4	NA	0.2	NA	NA	NA	0.1	NA	NA	NA
Etch BC_2F_6	NA	NA	NA	NA	NA	0.1	NA	NA	NA
CVD 1–U_i	NA	0.6	NA	NA	0.1	0.1	NA	0.3	0.4
CVD BCF_4	NA	0.2	NA	NA	0.2	0.1	NA	NA	NA

Notes: NA denotes not applicable based on currently available information.

TABLE I–8 TO SUBPART I OF PART 98—DEFAULT EMISSION FACTORS (1–$U_{N2O\ j}$) FOR N_2O UTILIZATION ($U_{N2O\ j}$)

Process type factors	N_2O
CVD 1–U_i	0.8
Other Manufacturing Process 1–U_i	1.0

Subpart J [Reserved]

Subpart K—Ferroalloy Production

§ 98.110 Definition of the source category.

The ferroalloy production source category consists of any facility that uses pyrometallurgical techniques to produce any of the following metals: ferrochromium, ferromanganese, ferromolybdenum, ferronickel, ferrosilicon, ferrotitanium, ferrotungsten, ferrovanadium, silicomanganese, or silicon metal.

§ 98.111 Reporting threshold.

You must report GHG emissions under this subpart if your facility contains a ferroalloy production process and the facility meets the requirements of either § 98.2(a)(1) or (2).

§ 98.112 GHGs to report.

You must report:

(a) Process CO_2 emissions from each electric arc furnace (EAF) used for the production of any ferroalloy listed in § 98.110, and process CH_4 emissions from each EAF that is used for the production of any ferroalloy listed in Table K–1 to subpart K.

(b) CO_2, CH_4, and N_2O emissions from each stationary combustion unit following the requirements of subpart C of this part. You must report these emissions under subpart C of this part (General Stationary Fuel Combustion Sources).

[74 FR 56374, Oct. 30, 2009, as amended at 75 FR 66461, Oct. 28, 2010]

§ 98.113 Calculating GHG emissions.

You must calculate and report the annual process CO_2 emissions from each EAF not subject to paragraph (c) of this section using the procedures in either paragraph (a) or (b) of this section. For each EAF also subject to annual process CH_4 emissions reporting, you must also calculate and report the annual process CH_4 emissions from the EAF using the procedures in paragraph (d) of this section.

(a) Calculate and report under this subpart the process CO_2 emissions by